N.A.C.A. BULLETIN

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EDITORIAL DEPARTMENT NOTE

A financial forecast may disclose both hazards and opportunities and may provide a test of reasonableness against which to set off less studied reactions to the operating position of a company. However, as the author of our first article points out, the forecast must be complete, must avoid confusing detail, and must be self-checking as to mechanics of preparation. Procedures to this end are given in a fair degree of particular.

JOHN G. ROBERTSON, Jr., the author, is Manager of the Financial Forecast Department of Lockheed Aircraft Corp., Burbank, Calif. Mr. Robertson has been associated with Lockheed for seven years, following two years in public accounting with Lybrand, Ross Bros. & Montgomery.

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The operations of few companies permit preparation of monthly reports simultaneously with the close of the month, when they are much in demand. The second article in this issue proposes a projection procedure for such statements, based on data summarized from the books, which offers daily cumulative information for conversion into a full month's performance. Such information is intended to afford a basis for overcoming subnormal performance early in the month and for providing quasiactual operating statements promptly at its close.

The author of the article is EDWARD W. HARTMAN, Cost Accountant, Bowser, Inc., Fort Wayne, Ind. Mr. Hartman joined the staff of his present company recently after ten years as general and plant accountant with Farnsworth Radio & Television Corp. He has been engaged in industrial accounting since 1933 and is a previous contributor to the *Bulletin*.

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What scale of operations shall a company attempt to realize and control, when, as in the case of many small or new firms, sales potential is an unknown and may be wholly dependent on the resourcefulness of the sales staff? Our third article describes a budget building procedure which starts with an inventory of machines and a tally of the labor personnel required to operate them at capacity. Throughout, emphasis is laid upon realization of the profit possibilities of existing physical plant.

The presentation is offered by F. E. BARIDON, Secretary and Assistant Treasurer of the Barden Corp., Danbury, Conn., with which he has been connected since 1944. Mr. Baridon has had extensive experience in industry in both the personnel and accounting fields. During most of the war period, he was Chief Works Accountant with Remington Arms Co., Bridgeport, Conn.

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Cost estimating in support of price quotations is particularly hazardous today, and doubly so if the period over which the costs are actually to be incurred is measured in terms of a few years rather than a few months. The factors considered and procedures followed under these circumstances in a job machine shop are reported upon in our final presentation.

FRED W. MURRAY, the author, is a Member of the Staff of Jordan & Jordan, Public Accountants, Portland, Maine, with whom he has been associated since 1939. Mr. Murray was formerly connected with National Dairy Products Corp. in Portland and as a travelling auditor out of the New York office. He has also been Controller of Atlantic Research Associates.

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AUGUST 1, 1948

THE TECHNIQUE OF FINANCIAL FORECASTING

by JOHN G. ROBERTSON, Jr.
Manager, Financial Forecast Department,
Lockheed Aircraft Corp.,
Burbank, Calif.

AS every controller knows, financial forecasting is nothing new under the sun. Some sort of estimate of the flow of working capital through the respective stages of cash, inventories, and receivables is essential in order to obtain the best use of working funds. The necessity for this type of financial planning has been emphasized during the postwar period by the wide fluctuations of costs, prices, and volume which have occurred. Many companies have literally been forced to plan their operations with greater care than in periods of more stability. Consequently, more attention is today being given to complete and accurate forecasts than ever before.

Furthermore, a broader concept of the usefulness of forecasting is taking form. Rather than being limited in use to the officers concerned with financial operations, forecasts are in many cases serving as guides to top management in formulating basic operating plans. A forecast is a means of expressing such plans in financial terms so that their results can be measured. As such, it is an integral part of sound planning and a valuable tool for top management.

What Is a Financial Forecast?

A financial forecast is an estimate of the results of operations of a business for a future period. Most commonly, it takes the form of estimates of profit, cash position, and such other data relative to the future as will be useful to management. It differs from a budget in that it is intended to show what is most likely to happen, whereas a budget tells what should happen. It is, however, closely related to a budget and can be used as a summary or master budget.

In general, the forecast should follow the form of the company's financial statement. Since the forecast is intended to act as a guide for management in formulating decisions which will affect the company's financial position, it should provide the same information relative to the future that the financial statement does

relative to the past. And as the financial statement is presumably in the form which is most useful to the management, the forecast will naturally assume the same appearance. In addition, in order to follow up and compare the forecast with actual results of operations, it is desirable that the forecast and actual information be arranged in the same manner.

Three financial statements are usually considered essential to financial management: (1) the profit and loss statement, (2) the cash statement, and (3) the balance sheet. The first two reflect the changes that have taken place in the company's position during the period under consideration. These statements deal with essentially the same items of income and expense, the principal difference between them being the matter of timing. The balance sheet, on the other hand, deals with the status of the business at a given moment of time. These three statements form the backbone of the forecast, just as they do of the actual financial statement.

Such additional statements may be prepared as are deemed desirable, either on a regular basis or as special studies to take care of a particular situation. The information needed will usually be readily available from the working papers prepared for the three basic statements referred to above. Examples of additional statements which might be useful to management are working capital or source and application of funds statements, inventory analyses, fixed asset forecasts, sales and gross profit analyses, bond amortization schedules, investment studies, break-even charts, and many others. The data gathered in the preparation of the forecasts can also be used in numerous other ways. It can be given in the form of charts, written notes or reports, or as blackboard presentations. Once the information is prepared, the form and manner of its presentation can take widely divergent paths, the only criterion being how best to put it over.

Timing of Forecast

How long a period should the forecast cover? How often should it be prepared or revised?

The period covered will vary, of course, depending upon the needs of the business and the length of time possible to forecast accurately. In an industry which sells in a stable market, it is frequently possible to forecast accurately as far ahead as economic trends can be reasonably extended. On the other hand, a company

whose sales are made on a contract basis may find it impossible to project its operations beyond the date of expiration of its current contracts. Sometimes the length of a forecast is determined by a particular situation, an example might be the date of expiration of a bank loan or bond issue. It can probably be stated as a general rule, however, that a forecast should cover at least one and at most five years if it is to be of maximum value.

The frequency with which forecasts are prepared or revised also depends largely on the nature of the business. In general, frequency of preparation should probably be between three and twelve months. Even if revisions are scheduled less closely, the forecast should be reviewed monthly or quarterly and revised if changed conditions warrant. The Lockheed forecast is prepared quarterly and reviewed monthly. The period covered is never less than one year and normally not more than two years. The forecast consists of four schedules: a profit and loss statement, a cash statement, and a working capital statement (all by months) and comparative balance sheets (at semiannual dates).

Data Used in Preparation of Forecast

The kinds of information used in forecast preparation may be many and varied, all the way from the factual data embodied in contracts to pure guesses (which are sometimes necessary and may be quite satisfactory if based on accumulated experience or judgment). In general, forecast sources fall into the following categories:

1. Management's policies and plan of operation which are expected to govern corporate activity during the period of the forecast.
2. Budgets which have been approved by management and constitute detailed operating plans.
3. Individual forecasts and estimates of future operations obtained from operating departments.
4. Studies of past experience from company records from which trends may be determined.
5. Analyses of statistical data from outside sources, used in determining trends of sales, wage rates, prices, etc.
6. Available information on external factors which may affect operations, such as Government policies, tax laws, and availability of material.

In utilizing information obtained from these various sources, a great deal of care must be taken to see that the figures used are reasonable and consistent. The basis of any statistical data should be well understood to avoid the danger of conflicting premises. Informal estimates obtained from operating personnel should be carefully weighed and checked in every possible manner.

Steps in Preparation of Forecast

The following steps, which are those used in the preparation of the Lockheed forecast, represent a practical approach to forecasting a manufacturing operation, although by no means the only possible sequence:

1. Operating statement
   a. Sales
   b. Costs and expenses:
      (1) Material
      (2) Direct labor
      (3) Overhead
2. Cash statement
   a. Receipts
   b. Disbursements
3. Balance sheet
4. Working capital statement

The sales forecast is selected as the starting point since it is the key to expected operations. Once the sales have been projected, the costs and expenses are determined in relation to the anticipated volume. At this point, all the fundamental estimates of income and outgo have been made and the next step is to transpose these estimates into terms of cash receipts and disbursements. All of these transactions are then converted to journal entry form and applied to the actual balance sheet at the beginning of the period to obtain the forecast ending balances. Finally, the working capital statement is built up from the changes in the noncurrent accounts.

The Sales Forecast

Sales forecasting is a technique in itself and is entirely too broad a subject to be covered adequately in this article. There are two basic types of sales forecasts used by different types of businesses. The first is based on economic trends and is used by companies whose sales fluctuate in accordance with such trends. The second is used by companies whose sales are covered by long-term contracts, the terms of which can be used to project the sales volume.

Many companies, especially those producing consumers' goods, make sales forecasts based on economic trends for use in planning capital expenditures or advertising campaigns or in setting salesmen's quotas. Such forecasts are of value even when no use is made of them for financial forecasting and it is probably safe to say that sales forecasts are more numerous than any other type of forecast or budget. Forecasts of this type are generally based upon trends deduced from analyses of statistical data. Such data may relate to general business conditions, to conditions in a specific industry, or to the demand for a particular product or service. For example, a candy manufacturer's sales would probably follow the trend of general business conditions while those of a lumber company would be more closely related to the general health of the building industry. Other data might also be used to make the forecasts more accurate. A candy producer may find that his sales of nickel bars can be related to the curve of births with a lag of a few years. The present high birth rate is, in fact, causing extensive revisions in the plans of industries whose goods and services are used by babies, children, and adolescents. Such sales forecasts necessarily require much more than a mere mechanical extension of past data. Considerable judgment must be used in the selection of suitable bases, in the modification of apparent trends for expected changes in conditions, and in the interpretation of the resulting estimates in the light of all available knowledge.

Businesses whose sales are covered by long-term contracts have a relatively simpler task in forecasting volume though the possibilities of this type of forecast are necessarily limited to the period covered by contracts. Such companies are generally those producing relatively few units of large value, whose unit sales are too small numerically to afford a broad enough base for accurate statistical projection. The aircraft industry is a good illustration of this type of business, further complicated by the large proportion of sales made to the Government, which are unrelated to any business trend. In this type of business, the sales forecast can be based on the delivery schedule on which the production program is predicated, priced at the contractual amounts. When there is reasonable expectancy of additional contracts beyond the period covered, estimated deliveries and sales prices may be used to extend the forecast to the desired length.

Because it is the basis for the entire forecast, special care must be taken to see that the sales projection is reasonable. This is so particularly when it is prepared by the sales department as the familiar optimism of the salesman is apt to carry his estimates to unreasonable heights. Sales are limited not only by demand but also by supply. Hence, plant capacity, working force, and material availability must be considered before accepting the sales forecast as final.

Costs and Expenses

Obviously, reliable cost data are essential to accurate forecasting, which may be added to the many other functions using the end products of cost accounting. Standard costs may be particularly useful inasmuch as they are not merely historical data but are in a sense independent of time and, therefore, adaptable to an estimate of the future. However, standards must be used with care, especially when they represent allowances under ideal conditions rather than averages of actual performance. In the former case, variances are normal and should be provided for in the forecast. Similarly, any change in conditions which would affect the standards must be allowed for in the forecast.

In forecasting costs, a decision must be made as to the extent of detail into which it is desirable to go. Certainly it would be impracticable to duplicate the full accounting system. On the other hand, costs must usually be calculated in some detail if the final result is to approach reasonable accuracy. For example, if the sales of different products fluctuate unevenly during the forecast period and the gross profit varies among products, their costs must be forecast separately. When the number of products is large, they may be arranged in groups of similar items. In general, the minimum of detail which will yield a reasonably close result will be the best policy.

In building up the cost and expense side of the forecast, it must be remembered that these items are reflected in the accounts in two ways—as a charge to operations through cost of sales or expense and as a credit to cash. Thus, it is necessary to calculate them not only as they affect the profit and loss statement but also as they are paid for. For example, it is not enough to know the material cost of the articles to be sold during the coming year. We must also know how much of this material is on hand and how much is to be purchased and paid for each month.

Material

In general, material forecasting is best approached through unit cost. If the cost of material per unit of each product can be determined, the over-all material entering into cost of sales can readily be calculated by applying these unit costs to the forecast deliveries of each product. Ordinarily unit material costs are readily available from the bill of material, standard costs, price estimates, or past actuals obtained from the cost records. Often, however, such unit costs must be modified for use over an extended period. Factors like price fluctuations, product design changes, spoilage, and waste must be considered and allowance made for their effects.

In some cases it will not be possible to use unit costs and a substitute method of forecasting material must be worked out. One example that comes to mind is spare parts, which are usually of such volume and diversity that the unit cost of individual parts cannot practicably be employed. In this case, a percentage of forecast spare parts sales, based on past experience, may be used. Another example is a trial run or an experimental project of only a few units on which no experience is available. Here the basic estimate must be used even though it may not be as reliable as the costs used for production projects.

Once the material cost of sales has been determined, it is necessary to schedule receipts by month as a basis for forecasting payments. When possible, the assistance of the material scheduling or purchasing department should be obtained in this task, because they are in the best position to determine the time of receipt. In general, material receipts can be derived from material cost of sales by considering the interval required between receipt of material and the sale of the product. The basic schedule obtained in this way must, however, be modified to reflect purchases made out of sequence to take advantage of favorable price situations or for other reasons, as well as the inventory position at both beginning and end of the forecast period.

Where costs are accumulated on a contract or project basis, as in aircraft manufacturing, the forecast material costs can frequently be checked against an over-all project estimate. This check is helpful in assuring control over the forecast period costs. If purchase commitments by project are reported, the figures can likewise be used as a control to see that forecast purchases are not understated.

Direct Labor

When a company manufactures large quantities of standard products in which the labor cost is approximately uniform, direct labor can be forecast in the same manner as material, i.e., via unit costs based on standards or price estimates. If, however, products are not standard or are produced in relatively small quantities so that labor cost follows an improvement curve, direct labor forecasting becomes much more difficult. In these cases, however, some mechanism must have been evolved for use in setting prices or scheduling hiring or layoff programs and can be used for forecasting as well. Obviously, the direct labor forecast must be related to the sales forecast, and, as in the case of material, may be checked against project estimates where they are available.

More data is generally available on the scheduling of labor by periods than in the case of material. In most cases, the time span of labor input into work in process can be determined very accurately. Direct labor budgets or personnel forecasts are often available. In a period of fluctuating wage rates, such as the present, it is generally most satisfactory to forecast direct labor in hours and convert hours to dollars by means of average wage rates. The rates can be projected into the future based on the trend of the wage level within the company, in the industry, or in the surrounding territory. Provision should be made, of course, for extraordinary variations which can be anticipated, such as a coming revision in union contracts, a hiring program, etc.

Overhead

Considerable ingenuity is often necessary in forecasting overhead, owing to the variety of ways in which these costs arise and are applied. It is obviously impracticable to follow completely in the forecast the steps necessary to account for actual overhead costs. On the other hand, they must be projected in sufficient detail to yield reasonably accurate results.

This question arises in two phases, first, the source of overhead costs, and second, their disposition. Overhead costs are recorded by source in accounts such as indirect labor, supplies, taxes, etc., and normally these accounts are too numerous to be used in forecasting without some grouping. In determining the extent of grouping, it is first necessary to remember that we will be journalizing these forecast figures in order to work up projected balance

sheets. Hence, we cannot group items with dissimilar sources. To put this in another way, overhead costs which are *credited* to the same account may be grouped. For example, supplies and telephone expense may be grouped because they are both credited to accounts payable, but neither could be grouped with indirect labor which is credited to accrued payroll.

A second factor determining the grouping to be used is the method of forecasting each type of expense. Fixed expenses such as depreciation or prepaid property taxes must of course be shown separately, as they are usually written off on a period basis. Variable expenses such as supplies are projected as a percentage of a basic figure, most often labor but sometimes material receipts (e.g. freight in) or area used (e.g. maintenance). Many expenses are semivariable or follow a pattern peculiar to themselves.

The following grouping is used for manufacturing overhead in the Lockheed forecast and may serve as one example:

Grouping	*Balance sheet account credited*	*Basis of forecasting*
Indirect Labor		
Basic indirect	Accrued payroll	Direct labor
Holiday pay		Direct labor plus basic indirect labor
Vacations		
Sick leave, overtime premium, etc.		
Depreciation	Depreciation Reserve	Depreciable assets
Property Tax	Prepaid expense	Monthly write-off of tax bill
Accounts Payable	Accounts payable	
Supplies		Total labor
Heat, light, and power		Past experience
Freight		Material receipts
Compensation insurance		Total labor
Rent		Monthly payment
Miscellaneous		Total labor
Social Security Taxes	Accrued taxes	Total labor

Not all the twists and quirks of the accounting system have been followed in setting up this form. For example, some small items are paid in cash rather than through accounts payable, while others are charged to prepaid expenses rather than directly

to overhead. For simplicity, these items are considered as charges to overhead and credits to accounts payable with no appreciable effect on accuracy of the forecast.

The second phase of the overhead problem lies in the disposition of charges. To start with, selling and administrative overhead must be determined separately from factory overhead, since the former is charged to operations as incurred while the latter is applied to inventories. Again, factory overhead may have to be split into sections, if segregated between plants, departments, or other categories in application.

This problem may be met by allocating total forecast overhead among the various categories or by forecasting each type separately to start with. We have found a combination of both methods preferable. Separate forecasts are made of administrative and sales overhead because of their relatively fixed nature, while factory overhead is determined as a total and then allocated to the three divisions of work in process recognized in our accounts: production, tooling, and development. The most desirable method would be determined by conditions in a particular case.

Profit and Loss Statement

All elements entering into the statement of operations have been determined at this point. Sales are obtained directly from the sales forecast and administrative and selling expenses from the overhead projection described above. Cost of sales offers more difficulty since it must be built up from the separate forecasts of material, labor, and overhead and since the methods used to determine it vary considerably among different industries. However, it is usually a matter merely of rearranging the basic data provided in the forecasts of the cost elements.

Items of other income and expense can be ignored where their effect is not material. When they must be included, however, some basis can always be found for their calculation. Discounts received can be arrived at as a percentage of payments of accounts payable. Discounts earned are related to sales. Interest expense is based on outstanding loans. Other items such as rents and royalties can be based on past experience modified by expected changes in conditions. After the determination of profit before taxes, Federal and state income taxes must be calculated, ordinarily as a straight percentage of profit.

Cash Receipts and Disbursements

Deriving cash receipts from the sales forecast will ordinarily present little difficulty. An examination of accounts receivable will disclose the normal length of time between billing and collection which, weighted by any unusual factors expected to influence future collections, will give the lag between sales and receipts to be used in the forecasts. Frequently different classes of sales or sales to particular customers will be subject to different collection periods, and these classes must then be calculated separately. Discounts allowed must be deducted from expected cash receipts. Provision must be made, of course, for any extraordinary receipts that can be anticipated.

In certain industries, receipts from sales are subject to more complex conditions. For example, Government contracts often provide for progress payments at a stated percentage of cost, which are later deducted from invoices as deliveries are made. Cost-plus-fixed-fee contracts have their own special rules and provision must be made for the time necessary for audits and for disallowed costs. Conditional sales and time payment plans must be considered. In general, however, these are special conditions which can be worked out individually.

Cash disbursements are ordinarily of a more varied character than receipts and must be calculated in some detail if the results are not to be distorted. Payroll disbursements are based on the direct and indirect labor calculated as described above under costs. From the total monthly payroll earned must be taken social security and withholding taxes and other payroll deductions. Next, this net earned payroll is converted to payroll to be paid, by calculating and applying the amount accrued at the beginning and end of each month. Payments on accounts payable are computed from the total of material receipts and the accounts payable items in overhead. This total represents monthly purchases and is converted to cash disbursements by applying a lag factor determined from actual experience. From the gross payments thus derived, the provision for discounts earned should be deducted.

Other disbursements should be scheduled in accordance with their normal or anticipated rate of payment. Social security taxes (employer's portion from the overhead schedules, employees' from the payroll disbursement calculation) are of course scheduled for payment each quarter. Federal and state income, sales, property, and other taxes are shown as paid in accordance with the re-

spective laws. Special payments for insurance, pension plans, or other items should be scheduled as they are expected to be made.

An estimate of the rate of expenditures for capital assets can usually be obtained from the personnel in charge of such expenditures. Where these items are substantial, it is often desirable to go into considerable detail in order to obtain accurate estimates. Such disbursements are recovered through sales only over a long period, in contrast to current expenditures for inventory. Hence, their effect upon the cash balance is relatively permanent.

Balance Sheet

Many companies forecast their profits and cash balances in a manner similar to that described above but do not carry their forecasts on to the balance sheet stage. We have found a balance sheet forecast worth while for two reasons. First, it acts as a check on the accuracy of the other estimates. If, for example, we have overlooked some item in computing cash receipts, accounts receivable at the end of the period will show as too high, thus flagging the error. I recall an instance in which the forecast cost of sales was out of line with the anticipated expenditures for labor and overhead and the ending inventory had a credit balance. It maintains the reputation of the forecaster to discover this sort of thing before his figures are presented to management.

Second, the balance sheet is valuable as a guide to management, just as the other forecast statements are. The cash and income statements each reflect changes in only one direction, whereas a comparison of actual and projected balance sheets reveals a more complete picture. It may, for example, show a trend toward building up inventory, which should be reversed if strain on working capital is to be avoided, or a dependence on tax reserves for financing, which must eventually be replaced by a more stable source of capital.

The forecast balance sheet is prepared by means of journal entries recording all transactions expected to occur during the forecast period. These are posted to a trial balance form. The accounts used in the balance sheet and the journal entries are both simplified and condensed as much as possible. Practically all normal transactions of the average business can be recorded in relatively few standard journal entries and if the forecast schedules are prepared with the balance sheet in mind, the entries can readily be made directly from the schedules.

The following entries will probably cover all except a few special transactions for a manufacturing business:

1. Sales and cost of sales.
2. Cash receipts and disbursements.
3. Direct labor.
4. Material.
5. Overhead—factory, and administrative.

Following up the Forecast

Any estimate of the future should be compared with actual results as they transpire. Regular comparison will reveal how closely the forecast can be relied on as a guide and may suggest ways in which actual results can be brought closer to those desired by management. Ordinarily monthly comparisons of actual and forecast profit and loss statements will be desirable and similar comparisons of cash receipts and disbursements. Other items of special interest, such as working capital or fixed asset expenditures, may also be analyzed in comparison with the forecast amounts.

If the original forecast was predicated on company policies in effect at the time of its preparation, a change in a major policy or condition may necessitate a revision. For this reason, a forecast should be reviewed from time to time and, if necessary, affected parts changed to reflect the new conditions. Along this same line, a forecast may be very valuable as a tool to show the financial effects of plans under consideration by management. This type of study, known to us as the "what-would-happen-if" statement, is prepared by incorporating these tentative plans in a previously prepared forecast and comparing the result with the latter to show the effects of the proposals upon profit, cash, working capital, etc.

A Reliable Guide

Certain conditions must be kept in mind in setting up a forecasting procedure. First and foremost, a forecast is a management report, most useful perhpas to the officers in charge of finance but potentially valuable to all of top management. For this reason, the forecast should be originated and used by management or it will be valueless. The person who actually prepares the statements must be kept fully advised of all developments affecting his work or the results will be incomplete and misleading. He should

have management's full support in obtaining necessary information from the operating departments.

The forecasting procedure must be detailed enough to follow the accounting system in all essential points or the results may not be comparable with the actual figures. At the same time, it must be condensed and simplified so that the forecast does not take too long to prepare. If its preparation extends over too long a period, it may be "cold" before it is completed. The procedure should be kept flexible so that changes can be incorporated easily and quickly. The working papers should be in logical form and sequence if the detail is to be readily available for comparison.

Can a forecast be made accurate enough to act as a reliable guide? Our experience has shown that it can if the conditions mentioned above are met. Is forecasting an expensive operation? No—a forecast based on a condensed and simplified procedure will not only take less time than an approach based on masses of detail, but will also yield better results. Since it is a highly integrated process, one or two men of high quality can do a better job than a larger number of detail workers.

Even so, is a forecast worth the effort it takes to make it? The complexities of present-day business, afflicted by a multitude of interrelated forces, make detail planning imperative. It is no longer possible in most cases to make major decisions without a guide which gives these forces their proper weight. A forecast provides such a guide by presenting a complete picture of operations under a given set of conditions.

COMING ARTICLES

In the *N. A. C. A. Bulletin,* August 15, 1948

Presenting the Facts for Disciplined Business Decisions
by Mason Smith

Applications of Generally Accepted Accounting Principles to Cost Accounting
by Donald M. Russell

The Background for Planning of Sales Incentive Compensation
by James C. Olson

PROJECTING THE MONTHLY PROFIT OR LOSS STATEMENT

by EDWARD W. HARTMAN,
Cost Accountant, Bowser, Inc.,
Fort Wayne, Ind.

THIS article is intended to help the controller or cost accountant to answer the questions of management that too often are answered something like this, "It will be a day or two before all the journals are completed and posted. We are unable to give you the profit (or loss) for the month until that has been done." Management is always asking for monthly operating results the day after the month closes and, in the critical times ahead, more and more executives will demand a current picture of the company's profit position.

It would be of great value to the company if the controller could develop a procedure so that a daily profit or loss statement could be presented. However, as this is impractical, the projected statement of profit or loss for which a procedure is suggested in this article may supply something of what is missing. Organizations that have standard costs in force and operate budgets, are already in posession of the necessary data for making daily or weekly projections in the pattern proposed. The following paragraphs will point out how this can be done simply, efficiently, and dependably. The procedure given does not reflect methods in operation in any company but it is believed that the proposal would prove practicable in many cases.

Definition of Projection

The term projection as used in this article is a means of preparing, daily within the month, constructive results for the month as a whole (converging ever more closely with the full month's actual results as the days pass) by utilizing principally facts reported daily. Projection as used here differs from forecasting in that forecasting is based on the best estimates of various personnel who are familiar with sales and cost figures and estimate a month's, three months', or six months' operations to the best of their ability and the facts at hand. A forecast depends upon the ability of the sales manager to predict future sales and the ability of the plant manager to set up a related production schedule, to which the industrial accountant can apply cost figures reflecting

expected operating conditions for the months covered. It is essentially a set of working estimates prepared without expectation that results will conform at all points. However, in projecting the profit or loss for the month, estimates are rarely used. The projected results are based on daily reports submitted by the billing, timekeeping, general accounting, and the cost departments representing, in the main, actual data.

A good example of the mechanics of the projecting process might be that of making the projection for productive labor variance for the month. The daily labor variances for the days worked to date are added and the accumulated variance is divided by the number of days worked to date to obtain the average variance per day. This result, multiplied by the number of work days for the month, gives the full month's projected productive labor variance as of that day. It will be noted that early in the month the projection will vary to a greater degree from final actual results than at the end of the month when the base of the projection has automatically been broadened to include the major portion of the period's actual transactions.

Master and Subordinate Projections

The several exhibits to this article illustrate further the accumulation and averaging technique described above and together show the extent and limitation of detail in which the operating data, as it develops in actual book entries during the month, are taken into subordinate schedules, arithmetically worked as indicated, and carried up to the master profit and loss projection, Exhibit 1. It should be kept in mind that each figure on this exhibit is a projection to the full month of performance for that part of the month which has passed. However, it does not mean that, because the projection as of February 5 is quite different from final results, it is necessarily in error *as of that date.* One of the natural effects of such figures as the early days of the month show would be to force measures of control and expediting which would result in a better performance for the period. Of course, as the month progresses, the projections do become more realistic line by line down the statement.

The remaining paragraphs of this article are devoted principally to indicating as concisely as possible what appear to be the readiest reliable means to carry figures from the accounting and other records into schedules supporting the master projection, bearing

PROJECTED PROFIT OR LOSS

February, 1948

Date	Net sales (Exhibit 2)	Cost of sales (Exhibit 3)	Variances (Exhibit 4)	Selling expense	Genl. and adminis. expense	Profit or (Loss)
2	$200,000	$120,000	$41,000	$58,000	$50,000	$(69,000)
3	300,000	200,000	36,000	62,000	50,000	(48,000)
4	400,000	293,000	32,000	64,000	50,000	(39,000)
5	400,000	280,000	29,000	66,000	50,000	(25,000)
	Data for intervening work days omitted					
24	694,000	487,000	30,000	77,000	50,000	50,000
25	689,000	487,000	30,000	78,000	50,000	44,000
26	705,000	493,000	30,000	79,000	50,000	53,000
27	750,000	524,000	29,000	80,000	50,000	67,000
Actual						
Jan. '48	900,000	650,000	36,000	85,000	50,000	79,000
Dec. '47	1,000,000	700,000	34,000	90,000	80,000	96,000
Nov. '47	1,200,000	850,000	24,000	100,000	60,000	166,000

EXHIBIT 1

PROJECTED SALES

February, 1948

Date	Today	Accumulated to date	Average per day	Average projected for 20 days (to Exhibit 1)
2	$10,000	$10,000	$10,000	$200,000
3	20,000	30,000	15,000	300,000
4	30,000	60,000	20,000	400,000
5	20,000	80,000	20,000	400,000
	Data for intervening work days omitted			
24	40,000	290,000	34,705	694,100
25	30,000	620,000	34,444	688,880
26	50,000	670,000	35,263	705,260
27	80,000	750,000	37,500	750,000
Actual				
Jan. '48				900,000
Dec. '47				1,000,000
Nov. '47				1,200,000

EXHIBIT 2

PROJECTED COST OF SALES

(Based on sales classified by gross profit margin)

February, 1948

Date	*Today*	*Accumulated to date*	*Average per day*	*Average projected for 20 days (to Exhibit 1)*
2	$ 6,000	$ 6,000	$ 6,000	$120,000
3	14,000	20,000	10,000	200,000
4	24,000	44,000	14,666	293,320
5	12,000	56,000	14,000	280,000
	Data for intervening work days omitted			
24	28,000	414,000	24,353	487,060
25	24,000	438,000	24,333	486,660
26	30,000	468,000	24,632	492,640
27	56,000	524,000	26,200	524,000
Actual				
Jan. '48				650,000
Dec. '47				700,000
Nov. '47				850,000

EXHIBIT 3

SUMMARY OF PROJECTED VARIANCES

February, 1948

Date	*Direct labor (Exhibit 5)*	*Unabsorbed burden (Exhibit 6)*	*Engineering changes (Exhibit 7)*	*Rework and repairs to product (Exhibit 8)*	*Material scrap, etc. (Estimate)*	*Total (To Exhibit 1)*
2	$16,000	$16,000	$4,000	$800	$4,000	$40,800
3	14,300	12,260	4,500	880	4,000	35,940
4	12,275	9,980	5,000	800	4,000	32,055
5	10,200	8,440	5,260	720	4,000	28,620
	Data for intervening work days omitted					
24	10,675	8,940	6,120	660	4,000	30,395
25	10,800	8,900	6,120	640	4,000	30,460
26	10,675	8,660	6,100	640	4,000	30,075
27	10,375	8,360	6,000	640	4,000	29,375
Actual						
Jan. '48	7,500	18,500	5,000	1,000	4,000	36,000
Dec. '47	9,600	9,000	8,000	1,500	6,000	34,100
Nov. '47	8,400	(500)	7,500	2,500	6,500	24,400

EXHIBIT 4

PROJECTED DIRECT LABOR VARIANCES

February, 1948

Date	*Actual hours*	*Standard hours*	*Labor variance hours*	*Accumulated to date*	*Average per day*	*Average projected (for 20 days)*	*Extended at avg. rate per hr. $1.25 (To Exhibit 4)*
2	1,600	960	640	640	640	$12,800	$16,000
3	1,680	1,176	504	1,144	572	11,440	14,300
4	1,640	1,312	328	1,472	491	9,820	12,275
5	1,592	1,433	159	1,631	408	8,160	10,200
			Data for intervening work days omitted				
24	1,692	1,015	677	7,251	427	8,540	10,675
25	1,720	1,204	516	7,767	432	8,640	10,800
26	1,720	1,376	344	8,111	427	8,540	10,675
27	1,900	1,710	190	8,301	415	8,300	10,375
Actual							
Jan. '48	24,000	18,000	6,000			6,000	7,500*
Dec. '47	40,000	32,000	8,000			8,000	9,600
Nov. '47	45,000	38,000	7,000			7,000	8,400

* Rate Increase

EXHIBIT 5

in mind that this must be done on a daily basis. These schedules are displayed in the following exhibits:

Exhibit 2, Projected sales
" 3, Projected cost of sales
" 4, Summary of projected variances
" 5, Projected direct labor variances
" 6, Projected unabsorbed burden
" 7, Projected variances due to engineering changes
" 8, Projected variances due to rework and repair to product

Every care must be taken that all of the figures are reasonably accurate and that all known factors are included in the projection. Care also must be taken that the number of working days are computed accurately since the difference between twenty working days, such as occurred in February 1948, and twenty-three working days in March 1948, will make a considerable difference in the elements used in the projection. Also it would be erroneous to

PROJECTED UNABSORBED BURDEN

	Projected Burden							Projected Burden Absorbed (Rate $1.50 per standard hour)				Projected amount unabsorbed (To Exhibit 4)
Date	Fixed expense	Indirect wages	Overtime premium	Total	Accumulated to date	Average per day	Avg. projected for 20 days	Standard hrs. x $1.50	Accumulated to date	Average per day	Avg. projected for 20 days	
2	$1,200	$1,000	$40	$2,240	$2,240	$2,240	$44,800	$1,440	$1,440	$1,440	$28,800	$16,000
3	1,200	950	40	2,190	4,430	2,215	44,300	1,764	3,204	1,602	32,040	12,260
4	1,200	1,000	40	2,240	6,670	2,223	44,460	1,968	5,172	1,724	34,480	9,980
5	1,200	1,100	40	2,340	9,010	2,253	45,060	2,150	7,322	1,831	36,620	8,440
					Data for intervening work days omitted							
24	1,200	950	80	2,230	38,790	2,282	45,640	1,523	31,203	1,835	36,700	8,940
25	1,200	950	80	2,230	41,020	2,279	45,580	1,806	33,009	1,834	36,680	8,900
26	1,200	1,000	80	2,280	43,300	2,279	45,580	2,064	35,073	1,846	36,920	8,660
27	1,200	1,100	400	2,700	46,000	2,300	46,000	2,565	37,638	1,882	37,640	8,360
Actual												
Jan. '48	24,000	20,000	1,500	45,500			45,500		27,000		27,000*	18,500
Dec. '47	26,000	21,000	2,000	49,000			49,000		40,000		40,000	9,000
Nov. '47	25,000	19,000	3,000	47,000			47,000		47,500		47,500	(500)

*Burden rate changed from $1.25 to $1.50 per Hour as of Jan. 1.

EXHIBIT 6

project on a basis of twenty working days when it is known at the beginning of the month that the plant will not be in production the last week of the month.

Similarly, it would be erroneous to project unusual sales into regular monthly sales. For example, a billing of $20,000 might be made on the first of the month for a special product and it might be known that no additional sales would be made during the month. If the formula were used blindly, this $20,000 sale of the first day of the month could be projected to $400,000 for the month. However, most companies have several lines of products that move with a certain degree of regularity and have standard cost of sales that can be used for projecting purposes.

Projecting Sales and Gross Profits

Almost every organization has a daily sales report of some kind showing the number of items or models shipped in a given line and the aggregate billing in the respective lines. If the daily sales figures are to be used in projecting the sales volume for the month, it would be well if the sales were accumulated by classes which have the same gross profit margins, to facilitate using the sales figures for gross profit projection also. Careful consideration must be given to the mix so that a realistic gross profit can be projected. Most companies have what is commonly known as a profit formula. The more competitive the product, the tighter the formula and the smaller the gross profit. Conversely, the less competition in the field, the wider the profit margin and the larger the gross profit.

If the daily sales reports do show sales by product classes, it would take little effort to extend the sales for the various products by the standard profit margin and arrive at standard gross profit for the day. Under these circumstances, the alternative of costing shipments daily at standard costs would achieve no better results and would be much more laborious. The gross profit projection is a particularly powerful tool for the general manager. If he is supplied with the projection at various times during the month and the indications are that a loss month will result unless more shipments are made (as illustrated by the figures used in the exhibits), he can immediately call in the sales and production managers to verify the trend as shown by the projection and to take necessary steps.

PROJECTED VARIANCES DUE TO ENGINEERING CHANGES

February, 1948

Date	*Today*	*Accumulated to date*	*Average per day*	*Avg. projected for 20 days (To Exhibit 4)*
2	$200	$200	$200	$4,000
3	250	450	225	4,500
4	300	750	250	5,000
5	300	1,050	263	5,260
	Data for intervening work days omitted			
24	200	5,200	306	6,120
25	300	5,500	306	6,120
26	300	5,800	305	6,100
27	200	6,000	300	6,000
Actual				
Jan. '48		5,000		5,000
Dec. '47		8,000		8,000
Nov. '47		7,500		7,500

EXHIBIT 7

PROJECTED VARIANCES DUE TO REWORK AND REPAIR TO PRODUCT

February, 1948

Date	*Today*	*Accumulated to date*	*Average per day*	*Average projected for 20 days (To Exhibit 4)*
2	$40	$40	$40	$800
3	48	88	44	880
4	32	120	40	800
5	24	144	36	720
	Data for intervening work days omitted			
24	24	560	33	660
25	24	584	32	640
26	32	616	32	640
27	24	640	32	640
Actual				
Jan. '48		1,000		1,000
Dec. '47		1,500		1,500
Nov.'47		2,500		2,500

EXHIBIT 8

Projecting Variances

Most plants using standard costs prepare daily operating reports which indicate the direct labor performance and the comparison of indirect labor to the labor budgeted. This report may also carry such information as overtime premium paid and number of hours spent on rework. Other pertinent information affecting the current month's operations, likewise included in the plant's performance report, will enable the cost accountant to project in dollars and cents and on a sound basis the variance resulting from labor performance.

It may not be quite so easy with material variances. Experience and spot-checking are the tools here. Daily reports are not as common as with labor. However, it is not entirely impossible that such a report in some simplified form would be an asset for control purposes and would supply reliable daily material variance figures in whatever classification detail is appropriate to the company.

Unabsorbed Burden Projection

Although projection of standard burden is covered by the gross profit projection, it is necessary to project actual burden and compute the absorption so that the profit and loss as developed by the projection procedure may bear an accurate charge for unabsorbed amounts. In projecting factory expenses and unabsorbed burden, the cost accountant should make occasional spot checks of current entries in the voucher register and journals to determine if any unusual expenses are being incurred that could affect his projection.

In preparing the projected burden expense, a separation must be made between the fixed expenses and variable expenses. Such items as depreciation, rent, taxes, insurance, etc., will be classed as fixed expenses and are reliably projected from known amounts. Inasmuch as it is sometimes difficult to project supply expenses, it would be well to consider the possibility of including a fixed amount for the month rather than trying to use a projection. If, however, the company's supplies vary greatly from month to month, it would be advisable to project the supply expenses on the basis of the month's outlay as it is made. Indirect hourly wages can be projected with a great degree of accuracy from a

plant performance report issued daily and the same is true of overtime premium pay.

The burden absorbed in inventory is commonly figured on the standard productive labor hour or dollar. If the plant operates in this manner, a summary as shown in Exhibit 6 can be made up readily. If the company uses machine hours or some other basis for absorbing burden, work sheets can be prepared which will produce similar results.

Selling Expenses and General and Administrative Expenses

The general accountant should be able to furnish a projection of selling expenses and general and administrative expenses with a fair degree of accuracy since most of these expenses are fixed and those that do vary, such as commissions, bonuses, and royalties vary with a fixed percentage of each product class sales. The general and administrative expenses are almost completely in the fixed category. However, it is necessary to review the voucher register and journals to be aware of any major entries to related accounts that may affect the profit picture.

Breaking in the Procedure

Because of the alertness which must be exercised in carrying through the projecting procedure on a basis which will attest to its reliability in providing prompt month-end data and perhaps as a control tool also, it may be worth while to develop it experimentally for a few months. This will permit checking results and working in loose ends before the method is offered to company managerial personnel for their guidance. One thing may be said. It has been attempted in outlining the construction of projections to keep them free from unnecessary and detailed refinements. This was in part to facilitate promptness and in part so that essential elements of the projection would not be omitted because of the distractions created by accumulation and tying in of excess of detail.

Most companies already have the basis for preparing projections. It is chiefly a matter of compiling the figures as indicated and so foretelling the month's operation with a greater degree of accuracy than is used in the month's forecast.

A CAPACITY BUDGET PROCEDURE TO SET TASK FOR PLANT AND SALES FORCE

by F. E. BARIDON,
Secretary and Assistant Treasurer,
The Barden Corp.,
Danbury, Conn.

IT may be time to consider the situation of new companies and small companies with very little if any sales backlog. What are the best measures which they can adopt to steer a safe course? Due to the tremendous demand in most lines, business is probably available to them but what basis can they use to scale operations and build inventories?

Sales Potential or Plant Capacity?

Can they afford to decide on the strength of their best estimate of potential sales? A small company making a top grade china serves for the purposes of this article to exemplify companies in this general position. From the Department of Commerce or other sources it is known that (say) $20,000,000 worth of china is normally sold annually in the country or a lesser sales area. Several questions come to mind, indicative of uncertainty. Will the volume be greater or less this year? What part of this volume represents high grade china? Many companies claim they make high grade china, but very few make top grade.

Let us assume that $2,000,000 represents sales of the grade of china made by the company in question. Can the company get a quarter of this business? The answer is: "Not without a terrific struggle with the larger, well established companies and other competitors, some of them perhaps new." Can the company safely forecast $400,000 in sales? This is surrounded by doubts. Perhaps the better way to get business is to convince the buyers who bought $18,000,000 of ordinary china that top grade china is a better buy. If the sales force can convert five per cent of these buyers, sales potential has much more than doubled. But who can tell? Certainly no human sales manager or other individual is equipped to forecast reliably under these circumstances.

Does such a company have to grope its way along in respect to its cost and scale of operations or is there some other solution? Instead of forecasting sales, guessing at items and sizes, and so

building up a production schedule with budgets to meet it, why not take various levels of plant capacity from the break-even point up and budget gross sales, production, and costs as results of utilization of facilities. It is easier to look ahead to what your expenses should be than what your sales might be. If you have a plant and equipment, that is the basic fact from this viewpoint. Both sales and operating departments have to do certain things consequent on this to make the venture profitable.

Considering Capacity

The questions that confront management in planning, when this approach is taken, are at least tangible ones. What is capacity? Is it limited by apparent bottlenecks? Not necessarily. Is equipment in balance? Very seldom, if ever, without steps to effect it. What about excess machinery, special machines, or operators servicing more than one machine? How do these elements affect capacity? These are the sort of questions that arise when the problem is considered from the capacity angle.

Capacity is not necessarily based on machine hours but on the productive labor hours obtainable from the plant, including bench work, making full use of equipment. The fact that a workman may operate more than one machine is a standard cost problem but not a problem for a capacity budget. Situations like the following will also be found, taking three departments as an example and assuming a two months' operating cycle:

	Dept. 1	*Dept. 2*	*Dept. 3*	*Total*
Capacity hours	800	1000	1200	3000
Hours worked:				
1st month	900	1000	1000	2900
3rd month	700	1100	1300	3100

In the first month a lot of new orders were apparently started in Department 1 and overtime was worked, while work in Department 3 dragged. In the third month conditions were reversed. Department 2 may, on the other hand, be somewhat of a bottleneck where activity always seems to be at a higher activity level than elsewhere, in order to keep up.

Machines and Men

Our first step was to have the production department furnish us with a list by operating departments showing the number and

kind of machines or bench operations in each. We then asked for the number of men required to operate this equipment at 100 per cent capacity, in the following detail:

Set up men	Inspectors
Set up and operate	Machine maintenance men
Operators	Group leaders, etc.

In the automatics department, for instance, it was determined that with eight machines only two setup men, two operators, one inspector, and half time of a group leader were needed to keep the equipment in full operation. The number of employees required to service operations at this level was also determined for all indirect and office departments in the company. In respect of the payroll department, the personnel necessary was naturally related to number of employees. This likewise applied to the personnel department. With respect to the maintenance department, the basis was estimated upkeep labor for the equipment.

The number of men reported as required was listed by department and classified as direct labor, direct inspection, supervision, or other hourly rated labor. The number necesary at certain levels below capacity was then derived from the capacity data as shown in the following tables which afford examples of a direct and an indirect department, respectively:

	100%	*90%*	*80%*	*70%*	*60%*	*50%*	*40%*
Grinding room							
Direct labor	19	18	16	14	12	10	8
Direct inspection	4	4	4	3	3	2	2
Supervision	1	1	1	1	1	1	1
Other hourly	2	2	2	2	1	1	1
	26	25	23	20	17	14	12
Toolroom							
Hourly rated	16	16	15	15	14	14	13
Supervision	1	1	1	1	1	1	1
	17	17	16	16	15	15	14

As a point of interpretation in connection with the toolroom estimates, it may be mentioned that new products are being tooled

up so that, even at a low level of production, tool work will be heavy for a period of time.

Hours and Dollars

Using the standard forty-hour week as a base, budget hours for each level of activity were obtained by multiplying by forty the number of employees scheduled at capacity. Direct labor hours in the operating departments were reduced approximately ten per cent for lost time and this difference was added to the "other hourly" classification as set forth below. This is shown (rounded) in the adjustment of the hours in the 100% column. Whenever in other columns, the hours as initially extended are based on the same number of men as the next higher activity, there is a further adjustment of direct hours to "other hourly" so that direct labor hours will remain proportional to activity:

	Employees			*Hours*			*Adjusted Hours*		
	100%	*90%*	*80%*	*100%*	*90%*	*80%*	*100%*	*90%*	*80%*
Direct labor	8	8	7	320	320	280	290	260	230
Other hourly	1	1	1	40	40	40	70	100	90

A weighted average hourly rate, based on the top rates for the jobs involved less (usually) 10 cents an hour, was then established at each level. This rate included an increment for pay increases. As the number of employees dropped at the various levels the average rate used was increased slightly to reflect the gradual elimination at reduced activity of the lower rated, less experienced employees. The extension of these rates by the capacity (or percentage of capacity) hours established the budgeted weekly wages for hourly rated employees. Where salaried supervisors were involved, the weekly equivalent of their salaries was then added. Transfers from direct labor to other labor, referred to above, were effected at direct labor rates. The resulting weekly labor budget would show much as follows for each department:

	100%	*90%*	*80%*
	(Based on adjusted hours)		
Direct labor	$346	$310	$274
Other direct labor.....	35	71	60
Other hourly	40	40	40
	$421	$421	$374

A subsequent conversion of weekly hours and wages to a monthly figure was made by multiplying by 4.30. This conversion could be more exactly made if a thirteen-month year or even a series of four, four, and five-week months were in use. The weekly figures serve to implement control within periods. The monthly figures determine budget allowances for labor as described later.

Overhead

Burden presents a different problem. In a smaller organization, it is necessary to compromise between theory and practicality. Consequently with us, only salaries and wages are distributed and budgeted departmentally. They are the only expenses which are applicable to individual departments in small doses and are fairly stable. In any event, they comprise almost sixty per cent of the overhead. Other overhead expenses are currently charged on the books either to factory burden or to general and administrative expense and the same division is made in the budget. The accounts are listed in three general groups:

1. Controllable departmental expense
2. Controllable general expense
3. Taxes, insurance, and other fixed charges

By projecting each subaccount at the same activity levels related to capacity, taking into consideration the character of the expense, whether variable, semivariable, or fixed, and applying past experience and knowledge of what has to be done (e.g., in the matter of new tooling), budgets were established for both the factory and the office. These provide for normal expense but to save the administrative group embarrassment in case an abnormal legal fee or other unavoidable item is forced upon them, the special charge will be considered apart from the budget allowance. Such a fee might easily be half as large as the controllable general expense allowance in any one month.

It might be mentioned that the usual straight line variable budget was constructed and charted, using 100 per cent activity. This also included the fixed portion as calculated by formula. When we plotted our capacity budget figures, we found that we did not have a straight line and that profits at 80 per cent were included as only 80 per cent of what the chart showed.

MONTHLY BUDGET

	Levels	
	100%	50%
Direct Labor		
Hours: Operating	16,000	8,000
Inspection	6,000	3,000
	22,000	11,000
Dollars: Operating	$14,000	$ 7,500
Inspection	5,000	2,500
Total	$19,000	$10,000
Factory Burden		
Salaries and wages		
Direct departments	$ 4,500	$ 2,500
Indirect manufacturing departments	12,000	10,000
Engineering department	4,000	3,000
Other indirect departments	1,500	800
Bonus, vacations, etc.	2,000	1,500
	$24,000	$17,800
Less transfers out (return through expense)	4,500	3,800
	$19,500	$14,000
Controllable expenses		
Departmental	$19,000	$ 6,000
Factory—general	3,000	2,000
Fixed expenses	8,000	7,000
	$30,000	$15,000
Total	$49,500	$29,000
Per cent to direct labor	260%	290%
Total factory budget	$68,500	$39,000
Commercial Expenses		
Salaries and wages	$ 8,000	$ 6,000
Controllable expense		
Departmental	200	100
General	3,500	2,100
Fixed expenses	800	500
Total	$12,500	$ 8,700
Other Income and Deductions	$(200)	$(100)
Income	800	400
Deductions		
Net	$ 600	$ 300
Total Budget	$81,600	$48,000

EXHIBIT 1

We believe we have a little more realistic picture of where we should stand at the various activity levels.

Operating Under the Budget

It will be apparent that we have at this point a labor budget at various levels of capacity built up in such a way as to serve for detailed and over-all control of operations at these levels—with capacity operation as the company objective—and a burden budget likewise related to capacity levels although perhaps less closely tied to the physical facts of operations. Materials have not been dealt with—although they will be, briefly—because our control of these, like our sales efforts, is intended to follow from rather than unduly influence the conduct of our central control of operations, which lies in effective utilization of processing capacity. Our monthly budget of labor and burden, which is in a sense a permanent budget carrying within itself the means of revision if basic data changes, may be summarized as in Exhibit 1, using hypothetical figures at two levels.

In operating under the budget, the allowances for the month are based on the monthly activity. This is determined as the ratio of the current month's direct labor hours to the allowable direct labor hours at capacity. If the percentage turns out to be 72 per cent, then one-fifth of the difference between the allowances at 80 per cent and 70 per cent capacity levels is added to the latter. This method was found to be more satisfactory than taking the next higher or the nearest level for which allowances had been set. If a variable expense allowance is involved, the adjusted figure will be closer to reality and an item which is not variable will not change the current total. The over-all company activity rate is applied to all inspection and indirect departments, including administrative, and to expenses other than salary and wages, but individual activity rates are calculated each month for the operating departments.

Comparisons

We also account for realized price margins as compared with standard, change in work-in-process inventory, and variations in net profit. These comparisons may be illustrated by figures taken from Exhibit 2, Net Profit Budget, plus assumed actual sales and costs. For example, if standard cost of sales is $59,800, the standard sales value is, as shown in the 80 per cent column, $80,-

NET PROFIT BUDGET

	Capacity Level		
	100%	80%	50%
Sales			
Gross sales	102,000	81,600	51,000
Less—returns	2,000	1,600	1,000
Net	100,000	80,000	50,000
Budgeted Costs			
Material	5,500	4,500	3,000
Labor	19,000	15,300	10,000
Burden	49,500	40,000	29,000
	74,000	59,800	42,000
Sales and administrative expense	12,500	10,200	8,700
Other deductions, net	600	500	300
	13,100	10,700	9,000
Total budget	87,100	70,500	51,000
Net profit	12,900	9,500	(1,000)
Per cent to sales	12.9%	11.9%	(2.0)%

EXHIBIT 2

000, using 135 per cent as a standard margin indicator. If actual sales are $82,000, there has been a price gain of $2,000.

Inventory change is related to plant activity and we endeavor to show the reasons for the increase or decrease each month. Only in-process inventories are considered. Let us assume that the plant activity is 100 per cent as against sales at the 80 per cent level as noted above. Then the following inventory changes might be representative:

Budgeted manufacturing cost at 100% production	$74,000
Budgeted manufacturing cost at 80%	59,800
Increase in inventory due to low sales	14,200
Actual expense over budgeted expense	2,000
Actual cost-of-sales over budgeted ($62,000-$59,800)	(2,200)
Net increase in in-process inventory	14,000

Another comparison shows variations in profit from what should be realized at the 100 per cent level, and is constructed as follows:

Anticipated profit at 100%	$12,900
Sales volume loss at 80% ($12,900-$9,500)	(3,400)
Sales price gain noted above	2,000
Cost-of-sales excess over standard	(2,200)
Sales and administrative gain over budget	600
Actual profit	$9,900

In this example, we would still show a gain of $400 over the profit forecast at the 80 per cent sales level because the sales price gain and the excess cost-of-sales loss nearly offset and we saved $600 on selling and administrative expense.

Keeping Inventories Within Limits

Limits have also been set on the amount of raw material and in-process inventories that are allowable at the various capacity levels. In other companies, these will, of course, vary by industry or types of product and operating cycle. In our company, it might be something like this:

	100%	50%
Raw materials and purchased parts		
In stock	$ 90,000	$ 60,000
In process	150,000	80,000
	$240,000	$140,000

The Sales Budget as a Result of Plant Activity

If anticipated expenses are restricted to the pattern and by methods which have been outlined, then the task cut out for the sales department can be budgeted for them. Their goal would be to achieve the applicable sales volume for net profit percentages noted in Exhibit 2 which incorporates allowable costs from Exhibit 1 plus material costs. This would mean aiming for sales of capacity production to yield at least $102,000. Of course, before setting this goal in dollars and hence determining the budgeted net profit, consideration is given to what is possible to realize by way of prices at any level.

In respect of setting prices, so far as it is possible to maintain a cost basis, it is probable that in most companies sales estimates are based on normal burden rates which are arrived at from past experience. But what is the normal budget for a new company? Perhaps ours will be at 80 per cent of capacity eventually. In

the meantime our cost estimates for minimum lots are based on the 100 per cent level to which a profit factor is added, bringing prices up as high as the traffic can bear in accordance with the sales department's survey of the market. However, our basis of thinking and acting is founded on full utilization of manufacturing facilities at our disposal.

Working back from capacity net sales of $102,000 a month at the average profit margin indicated, the break-even point would be at slightly over the 50 per cent activity level. In our case, we eventually decided that the profit margin was too low and break-even point too high. Budgeted costs have since been revised downward. A two thousand dollar cut in the above budget at the 50 per cent level should result in a thousand dollar profit instead of a loss, with progressive increases at the higher activity levels.

As a new company we cannot expect too much from our sales department in the way of forecasts, at least not enough to establish a budget from them. We can, however, use such forecasts together with an analysis of open orders as a guide in planning our purchases of raw material and fabricated parts, production schedules, and new tooling, as well as our activity level in the near future. The sales department also knows what profit margins they must maintain on the average and the volume of business they must secure to keep the plant profitably busy and above the break-even point.

Conclusion

Even if more or less reliable sales forecast were available we believe the type of budget here described is more informative to us, requires less by way of continuous reconstruction and is more easily handled where business fluctuates than a budget based on such forecasts. Until the time arrives at which business exceeds present capacity and new equipment is needed, no radical revisions should be necessary. Neither is the capacity budget tied down to dates or periods but sets a continuous goal for planning and striving to keep the plant busy and on a profitable level.

COST ESTIMATING FOR LONG-TERM CONTRACTS IN A MACHINE SHOP

by FRED W. MURRAY,
Staff Member, Jordan & Jordan,
Portland, Maine

JOB order machine shops with long-term contracts have many cost estimating problems far different from production line manufacturers. When estimating must be done on a contract to be completed one to three years later, many factors must be considered. Necessary material commitments must be made and, even if it is possible to enter into contracts for these which will be binding on suppliers, replacements or lost materials must be purchased at prices prevailing at the time they are needed and this circumstance is likely to result in a change in the original contract price for materials for the job as a whole. Labor must be projected for the length of the contract and under present conditions only a crystal gazer could plan reliably for longer than the current employment contract. Finally, the variable elements of burden in a job order shop, fluctuating with orders on hand, require much planning on the part of production and administrative departments, to forecast this factor for a long term.

Gauging the Future Level of Cost Components

In estimating material costs, a detail of all items which are not to be taken from the regular inventory should be given to the purchasing department to obtain firm quotations. To these quotations should be added the cost of items needed from the present stock and these should be earmarked for the contract in question. To the total there should likewise be added an amount for items which may be spoiled, lost, or not taken into consideration at the time of the estimate. This amount is usually on a percentage basis arrived at through experience. Under normal circumstances, the aggregate of these costs should be an accurate forecast differing little from final cost of materials.

Labor must be given more thoughtful consideration, and national trends and indices must be studied to establish a rate which would be considered fair. Other factors to be considered are local demands for workmen, the possibility of using less skilled workers to cushion increased wage demands, any contract re-

strictions for amount of work to be completed in a given time, and many other items entering into labor relations and resulting fluctuations. As labor commitments cannot satisfactorily be made for long periods at the present time, it is necessary to arrive at prospective cost of labor for long-term contracts by conferences with all departments and by experience and judgment on the part of the cost estimator.

Burden is the most troublesome of all factors since a rate must be established from one to three years ahead of its application. The best method of approach, in our opinion, is to prepare a budget for three years and from this a break-even chart establishing the approximate amount of operating overhead which will be expended at any given volume. This figure should be determined by considering past records and current forecasts in consultation with all operating heads who will ultimately have to attempt to work within the amount of overhead set as allowable under the break-even chart.

Historical Information and Shop Data

With the above three items based on fact or studied fiction, as the case may be, an analysis of market conditions should be included with the summary of estimated costs given to sales department personnel for quoting purposes so that they may be properly governed with respect to important contingencies, whether these portend (as now) rising costs or (in time) a falling market for materials and labor. It is just as necessary in estimating for long-term contracts to consider possible cost declines as compared with current market as it is to cover additional costs.

If the sales quotation in question is for a machine similar to one previously built, much of the information may be taken from the completed bill of material applicable to the older item in so far as physical data such as quantities, weights, kind and grade of material, hours of labor, and experience in defective castings, machining, and excessive labor charges are concerned. As indicated in the beginning paragraphs, the related costs require an appraisal of the period during which the outlay will be incurred.

Where the work is new to the shop, estimates must be obtained from the engineering and production departments as to quantities of materials and the hours required for planning, producing, and assembling. An entirely new machine presents the most difficult problem. Here it is safest if the contract can be written

on a cost-plus basis, or with escalator provisions applying to labor and material costs. The lot of the cost estimator will be much simplified. Even limited escalation will help in the case of sudden market changes. However, even if this is done, it may be desired to estimate the approximate cost to establish a stated limit in the contract.

Procedures and Forms

Up to this point, we have chiefly recited the hazards involved and considerations necessary in estimating job costs for pricing purposes when costs will be incurred over a future period. What about specific procedures? What minimum information is necessary for accurate cost estimates under the circumstances? Before estimating, we fortify ourselves with a complete bill of materials and draw from file the historical cost records of similar parts made for previous contracts (Exhibit 1) and cost summaries of like contracts as a whole (Exhibit 2). We maintain to the best of our ability overhead budgets for three years ahead, and these we likewise use. Exhibit 2 is particularly important. As a form it is prepared both as an estimate before the job is quoted and a cost summary when it is complete. Having both the projection and result of previous jobs on hand helps immeasurably when it comes to taking one of the forms in blank and filling it in as an estimate for a new job.

In completing the bill of materials, each part is studied by the engineering and production dpartments to determine the rough weight, machining time, and other pertinent information such as possibility of spoilage due to foundry defects and warping due to violent and unusual temperature changes. The cost estimator should lend for this study all historical records he may have drawn from file of any similar machines or parts of machines previously constructed. Frequently this information is the most valuable aid given in completing a forecast because it shows the actual weight and time spent and any peculiarities affecting production or design in previous machinings. Likewise, in cases where similar machines or parts have been built, cost of designing, drawings, patterns, jigs and fixtures, and other items which must be made only once can be eliminated in arriving at the new cost.

Exhibit 1, the historical record of parts included in previous contracts, reveals costs of similar parts as taken from bills of material over several years. From this many studies can

Parts Cost Summary

Machine Group: Stream Flow Valves Type: 30 inch

Part Number: 4-H 11323 B-2 Ref: HFL 1-1 Description: 90° Elbow, 30" Dia.

Mach. No.	*Quan.*	*Material*		*Def. Material*		*Fdry. Labor*		*Def. Fdry. Labor*		*Smith Shop*		*Mach. Shop*	
		#	$	#	$	Hr	$	Hr	$	Hr	$	Hr	$
											Defective	8	10.00
16444	1	20	6.40	20	6.40							12	17.50
16497	1	21	6.72									9	11.25
16541	1	21	6.72									6	7.50
											Defective	7	8.75
16542	1	19	6.08	20	6.40							6	7.50
16543	1	20	6.40									5	6.25
16544	1	22	7.04									4	5.00

Remarks: Originally engineering department estimated material as 20 lbs. and production department estimated labor to complete would be 8 hours. These estimates are to be revised when Machine No. 16544 has been completed.

NOTE:—From experience in this group it appears necessary to make allowance for a defective charge due to difficulty in securing good castings. For future estimates use:

Material .....27 lbs. @ $ .32
Labor ..... 9 hrs. @ $1.25
F.W.M. 4/25/45

Exhibit 1

be made covering periods of depression, inflation, and normal conditions. These would allow the cost estimator to prepare his current estimates with proper adjustments for the projected period. Efficiency of labor and factors affecting it can also be appraised over a long period of time. Frequently such studies show whether highly skilled, high-priced labor or apprentice training or low grade labor can produce the lowest final cost.

In our opinion, this record gives more assistance than any other bit of available information, as it shows trends which may be portrayed graphically and compared with general business trends as translated in terms of present market and labor conditions. This study of trends results in weighted averages which are more accurate than the general average of the cost of all machined parts made, because so many factors have been taken into account.

Forward Budgeting of Indirect Costs

Before discussing in more particular the form of Exhibit 2, which is accompanied to the sales department by "water over the dam," i.e., file estimates and actuals in the same form for past comparable jobs, it may be well to cover the final supporting element involved in the estimating process and requiring searching the future to the extent that this can be done. This element is the forecasting of overhead. It contains perhaps even more unknowns than prophecies as to material and labor costs.

However, there are certain factors which can be taken hold of to construct tentative budgets of future overhead. We attempt it for a three-year period. These factors are:

1. Type of work on order and probable future orders in relation to the amount of overhead required.
2. Trend of business in general.
3. Local labor conditions affecting the overhead base, i.e., availability of workers and the demands of other local industries.

Type of work on order may be such as to require an initial factory overhead of a considerable amount whereas the same contracts toward their close may call for a very small percentage of burden and a higher direct labor cost. For example, in planning for a three-year forecast, we may find by reports from the production department that all current contracts for the period

Estimated Cost Summary

Description of Machine: 30" Stream Flow Valve
Estimate based on one (1) machine

Customer X Y Z Co.
Quoted: Price $950.00

Date 3/26/48
Finished Wgt. 750#

Material

Kind	Wgt.	@	Cost
H. T. Bronze			
Compo.	400	.35	140
Bronze	150	.38	57
Cast iron			
Cast steel			
Forgings			
Weldments			
Mach. Steel	250	.08	20
Babbitt			
Fittings			
Tubing—Pipe			
Gaskets & packing			4
Tanks			
Stores			6
Lumber—Patters			
Mat.—Shipping			2
Total (1)	800	—	229

Labor

Department	Hours	@	Cost
Machine	110	1.50	165.00
Assembly	15	1.50	22.50
Foundry			
Blacksmith			
Welding	1	2.00	2.00
Testing	2	1.75	3.50
Painting			
Shipping	2	1.25	2.50
Miscell.			
Total (3)	130		195.50

Dwg. & Pattern Labor

Description	Hours	Cost
Drawings		
Patterns	2	10
Development		
Total (4)	2	10

Patterns furnished by X Y Z Co. needed repairs.

Purchased Equipment

	Mfgr.	Cost
Electrical Equip.		
Electrical Spares		
Hydraulic Equip.		
Hydraulic Spares		
Reduction Gears		
Flex. Couplings	E Z Co.	100
Chain		
Gauges		
Oil Purifiers		
Oil Retainers		
Universal Joints		
Const. Disp. Pumps		
Anti-Frict. Bearings		
Weldments		
Tanks		
Total (2)		100

Final Price Summary

Material (1) & (2)	$329.00	
Labor (3) & (4)	205.50	
Overhead 180%	369.00	
Cost		903.50
Profit 5%		45.18
Contingencies		
Selling Price		948.68

Rough Weights

Mech. Parts	800	Mech. Spares	
Elec. Equip.		Elec. Spares	
Hyd. Equip.		Hyd. Spares	
Total (1) Machine		Total Spares	—

Estimated from C.C.S. 167 with prices adjusted to current market.

Exhibit 2

require a factory overhead of 20 per cent of direct labor for the first year, 100 per cent the second year and only 50 per cent for the third and last year. The sales department predicts no repeat items and the only prospective contracts, due perhaps to a decline in business conditions, are repair parts items. With a presumed outlook such as this, plans should be made to reduce the overhead expenditures and the forecast is so prepared.

Long-term contracts in process naturally do not reflect general business trends immediately. They reflect "booms and busts" only after a lag measured by the length of time required to complete work on hand, although terminations or defaults can and do occur. Nevertheless, if this is taken into consideration, some weight must be given in the expense forecast to general ups and downs in business.

Final Cost Estimate for Quotation Purposes

The data on Exhibit 2 exemplifies a completed estimate for a 30" Stream Flow valve. In looking at the form and the figures, it should be borne in mind that the actual cost will be recorded in the same manner for the benefit of later jobs and that the actual cost sheets for earlier applicable ones are attached to the current estimate as presented to management.

Briefly, the estimated detailed costs of materials, assemblies to be purchased, direct labor outlay of various categories, and drawings and pattern expense are shown concisely in blocks provided on the form, together with a summary estimate showing total material and labor costs and likewise burden applied at the budgeted rate. From these many elements, the final quotation is determined by adding a profit factor. For all practical purposes, this final estimate is regarded as conditioned as to accuracy by the supporting commentary which accompanies it to the sales department and points out the potential deviations from the estimated figures. However, with intelligent planning, a quotation accurate enough to be regarded as sound should be possible.

Cost estimating is not the job of any one department but rather the cooperative effort of every department. The cost accountant, because he has access to the records of all departments, is the logical intermediary among department heads. In accepting this responsibility he must realize that the accuracy and completeness with which the estimate has been prepared will influence and sometimes determine the profit or loss his company will realize.